

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

COMMUNICATION IN CASES FOR WHICH
NO OTHER FORM IS APPLICABLE

To:

FISHER ADAMS KELLY
 Level 13
 Amp Place
 10 Eagle Street
 Brisbane, QLD 4000
 AUSTRALIE

Date of mailing (day/month/year) 15 December 2000 (15.12.00)	
Applicant's or agent's file reference 2/7970/PC	REPLY DUE see paragraph 1 below
International application No. PCT/AU00/00364	International filing date (day/month/year) 26 April 2000 (26.04.00)
Applicant GONZALEZ, Ruben	

1. REPLY DUE within _____ months/days from the above date of mailing
 NO REPLY DUE, however, see below
 IMPORTANT COMMUNICATION
 INFORMATION ONLY

2. COMMUNICATION:

The International Bureau regrets to inform the applicant that, due to an error in our computer system, the above identified international application has not been published promptly after the expiration of 18 months from the priority date, as provided in PCT Article 21(2)(a).

International publication will now take place on 25 January 2001 (25.01.01)

Meanwhile, the International Bureau will communicate a copy of the international application to each designated Office, in accordance with PCT Article 20.

A copy of this notification has been sent to the receiving Office RO/AU and all designated Offices.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Beate Giffo-Schmitt Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)

Date of mailing: 25 January 2001 (25.01.01)	ETATS-UNIS D'AMERIQUE in its capacity as elected Office
International application No.: PCT/AU00/00364	Applicant's or agent's file reference: 2/7970/PC
International filing date: 26 April 2000 (26.04.00)	Priority date: 22 April 1999 (22.04.99)
Applicant: GONZALEZ, Ruben	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International preliminary Examining Authority on:

22 November 2000 (22.11.00)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer:</p> <p>J. Zahra Telephone No.: (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

PCT

COMMUNICATION OF
INTERNATIONAL APPLICATIONS

(PCT Article 20)

Date of mailing:

19 December 2000 (19.12.00)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE

in its capacity as designated Office

The International Bureau transmits herewith copies of the international applications having the following international application numbers and international publication numbers:

International application no.:

PCT/AU00/00364

International publication no.:

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer:</p> <p>J. Zahra</p> <p>Telephone No.: (41-22) 338.83.38</p>
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RECEIVED

PATENT COOPERATION TREATY

18 APR 2001

BY:

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

Date of mailing (day/month/year)
05 April 2001 (05.04.01)

From the INTERNATIONAL BUREAU

To:

FISHER ADAMS KELLY
Level 13
AMP Place
10 Eagle Street
Brisbane, QLD 4000
AUSTRALIE

Applicant's or agent's file reference
2/7970/PC

IMPORTANT NOTIFICATION

International application No.
PCT/AU00/00364

International filing date (day/month/year)

26 April 2000 (26.04.00)

1. The following indications appeared on record concerning:

the applicant the inventor the agent the common representative

Name and Address

State of Nationality	State of Residence
Telephone No.	
Facsimile No.	
Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person the name the address the nationality the residence

Name and Address
ACTIVESKY INC. 730 Bair Island Road Suite 101 Redwood City, CA 94063 United States of America

State of Nationality	State of Residence
US	US
Telephone No.	
Facsimile No.	
Teleprinter No.	

3. Further observations, if necessary:

The above-mentioned applicant should be recorded as an applicant for all designated States
except US. GONZALEZ, Ruben is now applicant/inventor for US only.

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer  J. Leitao
Telephone No.: (41-22) 338.83.38

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00364

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ⁷: H04N 7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04L; H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT, INSPEC: (video or imag+)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	US 6037991 A (Thro et al.) 14 March 2000 See column 4, line 66 to column 6, line 41 in particular	1 - 20
X	US 6028631 A (Nakaya et al.) 22 February 2000 (& WO 9627987, 12 September 1996) See the whole document, especially column 2, line 50 to column 3, line 44	1 - 20
X	US 5867821 A (Ballantyne et al.) 2 February 1999 See the whole document, especially column 5, lines 51 to 67	1 - 20

 Further documents are listed in the continuation of Box C See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 7 July 2000	Date of mailing of the international search report 13 JUL 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer R.W.J. FINZI Telephone No : (02) 6283 2213

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00364

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97/26744 A (Robb) 24 July 1997 See the whole document	1 - 20
A	US 5995150 A (Hsieh et al.) 30 November 1999 See the whole document	1 - 20
A	EP 930770 A2 (MITSUBISHI DENKI KABUSHIKI KAISHA) 21 July 1999 See the whole document	1 - 20
A	US 5867795 A (Novis et al.) 2 February 1999 See the whole document	1 - 20

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU00/00364

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	6028631	WO	9627987				
US	5867821	CA	2125300				
WO	9726744	AU	13636/97	CA	2243244	CN	1208529
		EP	875109	GB	9600804		
US	5995150	AU	26843/99	EP	978195	WO	9943147
EP	930770	JP	11205761				

END OF ANNEX

RECORD COPY.

PCT/AU 00/00364

1/3

PCT REQUEST

Original (for SUBMISSION) - printed on 26.04.2000 12:22:34 PM

2/7970/PC

0-1	For receiving Office use only International Application No.	PCT/AU 00/00364
0-2	International Filing Date	26 APR 2000 (26.04.00)
0-3	Name of receiving Office and "PCT International Application"	Australian Patent Office PCT INTERNATIONAL APPLICATION
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Australian Patent Office (RO/AU)
0-7	Applicant's or agent's file reference	2/7970/PC
I	Title of invention	WIRELESS VIDEO SURVEILLANCE SYSTEM
II	Applicant II-1 This person is: II-2 Applicant for II-4 Name (LAST, First) II-5 Address:	applicant and inventor all designated States GONZALEZ, Ruben 6 HERRINGTON CRES ARUNDEL HILLS BRISBANE, Queensland 4214 Australia
II-6	State of nationality	AU
II-7	State of residence	AU
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	FISHER ADAMS KELLY
IV-1-2	Address:	LEVEL 13 AMP PLACE 10 EAGLE STREET BRISBANE, Queensland 4000 Australia
IV-1-3	Telephone No.	+61-7-3229 2655
IV-1-4	Facsimile No.	+61-7-3221 0597
IV-1-5	e-mail	mail@fak.com.au

PCT REQUEST

Original (for SUBMISSION) - printed on 26.04.2000 12:22:34 PM

V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ DE DK DM EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW AG DZ
V-6	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	22 April 1999 (22.04.1999)
VI-1-2	Number	PP9901
VI-1-3	Country	AU
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1

▲ INSERTED
RO/AU

PCT REQUEST

Original (for SUBMISSION) - printed on 26.04.2000 12:22:34 PM

VII-1	International Searching Authority Chosen	Australian Patent Office (ISA/AU)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	3	-
VIII-2	Description	13	-
VIII-3	Claims	3	-
VIII-4	Abstract	1	abstract_onto_disc- 27970pc.txt
VIII-5	Drawings	3	-
VIII-7	TOTAL	23	
VIII-8	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-16	Fee calculation sheet	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-18	Figure of the drawings which should accompany the abstract	1	
VIII-19	Language of filing of the international application	English	
IX-1	Signature of applicant or agent	<i>M. Horsburgh</i>	
IX-1-1	Name	FISHER ADAMS KELLY	
IX-1-2	Name of signatory	MARK A HORSBURGH	
IX-1-3	Capacity	PATENT ATTORNEY	

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	26 APR 2000 (26.04.00)
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/AU
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	10 MAY 2000 (10.05.00)
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WIRELESS VIDEO SURVEILLANCE SYSTEM

This invention relates to an apparatus and method for wireless video surveillance and communication. In particular, it relates to an apparatus and method employing commercially available, hand-held 5 portable devices, such as personal information managers and personal digital assistants.

BACKGROUND TO THE INVENTION

The use of personal digital assistants (PDA's), such as the 10 3COM Palm Pilot®, is becoming very widespread. Functionality of PDA's varies between manufacturers but all include a liquid crystal display, an input device, memory and a processor unit. Various improvements are constantly being made to increase available memory, improve processing power and extend software applications.

15 Recently, PDA manufacturers have released devices having colour liquid crystal displays and wireless communication capability. This innovation has been driven by a desire to provide PDA's with internet access for web surfing and e-mail. Similar market pressures are driving the integration of processing capability into mobile phones 20 to facilitate direct web access for the same purposes.

It is also known to integrate PDA's with mobile phones to provide an integrated system giving full voice and data transfer facilities. One such system is described in United States patent number 5625673, assigned to Lucent Technologies Inc. The patent describes a PDA that 25 includes means for cordless connection to specialised accessories, such as a cellular telephone and a modem.

The capabilities of PDA's have not been extended for application in the video surveillance area. Existing surveillance systems, such as house security systems, do not normally offer a video surveillance 30 capability. When such a capability is provided, it is usually linked to a base station that provides remote manual surveillance.

The majority of existing surveillance systems utilise a local processing centre that packets data for transmittal to the base station. Transmittal may be by dedicated land-line or may be via a dial-up connection.

5

OBJECT OF THE INVENTION

It is an object of the invention to provide an apparatus and method for wireless video surveillance.

10 SUMMARY OF THE INVENTION

In one form, although it need not be the only, or indeed the broadest form, the invention resides in a wireless video surveillance system comprising:

- a portable monitor device and first wireless communication means;
- 15 one or more video recording means for recording video images of a scene; and
- at least one interface module converting said video images to transmittable data, said interface module incorporating a second wireless communication means for transmission of said transmittable
- 20 data from said at least one interface module to said portable monitor device, said portable monitor device incorporating means for receiving said transmittable data, converting said transmittable data to said video images and displaying said video images.

In preference, the portable monitor device is a personal digital assistant or similar hand-held processing unit incorporating processor means, memory means and video display means.

The video recording means may be a digital camera or may be a commercially available analogue video camera, such as a Camcorder®.

Suitably, the interface module includes input means for receiving video signals from said video recording means. A suitable input port is a USB port for digital video input. If an analog video recording means is employed, the input means suitably includes a video input port and

analog to digital conversion means.

The interface module preferably also includes processing means for converting said video images to transmittable data and one or more transmission buffers.

5 The wireless transmission means is suitably a signal transmitting means but is preferably a signal receiving and transmitting means.

The processing means of the interface module is suitably programmed with video and audio compression algorithms.

10 Corresponding audio and video decompression algorithms are suitably programmed in the processor means of the portable monitor device.

The portable monitor device suitably also includes input means for inputting signals for transmitting to said interface module. Preferably said first wireless communication means includes means for transmitting said signals and said second wireless communication

15 means includes means for receiving said signals.

In a further form, the invention resides in a method of providing wireless video surveillance including the steps of:

recording a video image of a scene;

processing the recorded image to form data for wireless transmission;

20 transmitting the data to a portable monitor device; and

processing the data to display the image on the portable monitor device.

Processing the recorded image preferably includes the steps of compressing the image at the interface means and decompressing the

25 image at the portable monitor device.

The method may further include the step of storing said data for later transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Preferred embodiments of the invention are described with reference to the following figures in which:

FIG 1 is a block diagram of a first embodiment of the invention;

FIG 2 is a block diagram of a first embodiment of the interface module;
FIG 3 is a block diagram of a second embodiment of the interface
module;
FIG 4 is a block diagram of a third embodiment of the interface
5 module;
FIG 5 is a block diagram of the portable video monitor;
FIG 6 is a block diagram of a second embodiment of the invention; and
FIG 7 is a block diagram of a third embodiment of the invention.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG 1 there is shown a block diagram of a wireless video surveillance system consisting of a video recording means 1, in signal connection with an interface module 2 which is in signal connection with an antenna 3. Signals 4 are transmitted between the 15 antenna 3 and an antenna 5 associated with a portable monitor device 6 which is a personal digital assistant or portable personal computer. Video images from the recorder 1 are displayed on a display 7 of the monitor 6.

Video and audio signals are transmitted from the interface 20 module to the portable monitor device and control signals may be transmitted from the portable monitor device to the interface module.

In the video recording means 1 is a commercially available VHS video recorder having standard video and audio outputs. Other video formats may include PAL, NTSC, SVHS, BETACAM, RGB, SECAM and 25 DVD.

A first preferred embodiment of the interface module 2 is shown in greater detail in FIG 2. In this embodiment the interface module is configured to transmit signals to the portable monitor device but is not configured to receive signals. Video and audio input from the recorder 30 1 is input through port 8 and converted to digital form in analogue to digital converter 9. The output from the ADC is buffered in dual frame buffer 10 for input to a digital signal processor 11.

Alternatively a digital camera could be employed as the video recording means 1. In this case, the digital output from the camera can be input directly to the dual frame buffer 10 through USB port 12. Although a USB port is described in the preferred embodiment, it will 5 be appreciated that other interface protocols such as SCSI, IEEE 1394, etc, can be used.

The digital signals are processed for transmission in the digital signal processing chip 11. The required processing will depend on the transmission network being employed and known signal processing 10 and compression algorithms can be used. Suitable algorithms include H.261, H.263, MPEG1, MPEG2, MPEG4, etc. Random access memory 13 is provided for on-board storage of data for signal processing.

Although a software implementation of the signal processing has been described, a hardware implementation is also suitable. In one 15 embodiment, signal processing can be performed using an ASIC (Application specific integrated circuit)/FPGA (Field programming gate array) solution. Alternatively, an ASIC front end can be used with a programmable DSP backend. The invention is not limited to any one of these possible solutions.

20 If a DSP solution is used, the DSP is programmed with available compression software. The invention is not limited to any particular software solution, although the inventor has 8-bit and 24-bit coding methods are suitable. Different coding methods may be more suitable for certain colour video displays available in the wide variety of PDA's 25 currently on the market. New coding solutions are regularly becoming available and the inventor recognises that the invention may employ new algorithms in the future.

The selected video compression method will implement three basic stages. The first stage performs temporal decorrelation, also 30 termed interframe coding. This process consists of an optional block based motion compensation step followed by temporal prediction and replenishment. This determines which portions of the image frame have

changed and selectively sends update information to reproduce the changes. This eliminates the need to retransmit the entire image each time when there have not been extensive change over time. A side product of this stage is that the output can be used to trigger an alarm

5 to be sent to the video monitor when any motion is detected.

Depending on the coding method used, quantisation may be performed at this point.

The next stage decomposes the resultant interframe images from the previous step into basic coding units. The nature of these

10 units varies depending on the coding method being used. In the classic transform based coding methods these coding units are 2D blocks of spatial frequency coefficients. These may equally be image primitives of another form such as run length vectors or uniform colour blocks. The values of the coding units are then substantially quantised

15 to eliminate unwanted information. This process is known as intraframe coding.

The final stage involves reordering the symbols or values to be coded so as to enhance compressability followed by some form of variable length or statistically based coding to efficiently create a

20 compact bit stream for each frame. This final stage is almost always lossless. This resulting bit stream is then appropriately packaged in a frame packet for insertion into the output data stream.

Audio coding will also be implemented in the DSP stage. In one embodiment a standard ADPCM compression method is used. GSM

25 speech coding will also be useful for use in conjunction with the integrated PDA/mobile phone scenario.

For each frame of video compressed and transmitted an audio frame of equivalent time duration will also be compressed and sent. In this way, excepting the event of system control frames in the data

30 stream, the predominant structure of the transmitted data stream will consist of alternating video and audio frames in an interleaved manner.

The processed data is buffered in transmission buffer 14 before

being transmitted by transmission module 15. The transmission module 15 can be any suitable wireless transmission system such as CDMA (code division multiple access), TDMA (time division multiple access), IP (wireless internet protocol), PHS (personal handyphone system), LMDS 5 (local multipoint distribution service), wireless ATM, GSM, GPRS, HSCSD and other 3G wireless networks. Alternative embodiments are discussed in detail below.

It will be appreciated that the elements of the interface module need not be physically contained in a single device. For example, the 10 transmission module may be separate from the rest of the interface module. For a wireless WAN protocol, the transmission module may be a GSM or CDMA base station connected to the rest of the interface module by a modem or ISDN connection. If the communication protocol is a wireless LAN, the transmission module may be connected to a 15 separate base station or wireless access point by an ethernet. The transmission module may also be a television frequency modulator to permit the device to transmit to a pocket television that may be in range.

A second embodiment of the interface module is shown in FIG 3. 20 This embodiment is configured to transmit signals to the portable monitor device as well as receive control signals. The DSP is replaced with a general purpose CPU 16. As with the first embodiment, video and audio signals are received at input 8, digitised by ADC 9, and buffered in DFB 10. Signals from a digital source can be input directly 25 on input 12.

As well as RAM 13 for local storage, an external storage device 17 is provided. The external storage device allows large volumes of data to be stored which can be accessed by signals from the portable monitor device. Two types of external storage devices may be 30 provided. Uncompressed analogue video data must be stored in a VCR which is accessed by a sequential, read-only access. Compressed digital data can be stored on any of a number of suitable devices

(including magnetic disks drives, digital tape drives, CD ROMs, DVDs, WORM drives, etc) with read-write, random access. There may be multiple external storage devices.

The external storage devices permit a history of video and audio

5 signals to be stored for review at a later time. One application of this arrangement is the removal and storage of recordings, such as video and audio tapes, for use in legal proceedings that could result from security breaches detected by the invention. Other applications are discussed below.

10 Signals 4 are sent and received by a transmit/receive means 18. A number of buffers 19 are provided for both transmission and reception. An output means 20 provides analogue or digital signals at port 21 for controlling various other devices in response to signals received from the portable monitor device. For example, a signal from

15 the portable monitor device could be used to turn lights on or off, reset a motion detector or external alarm, or commence video recording. In one application, a signal from the portable monitor device could be used to commence playback of a prerecorded programme stored on the external storage device 17.

20 A third embodiment of the interface module 2 is shown in FIG 4. This embodiment differs from the second embodiment by implementing a multiple address data bus 22. This embodiment facilitates the use of multiple external storage devices and multiple output means. It is also possible to implement multiple input sources which may each have a

25 unique address selectable from the portable monitor device. This embodiment provides maximum flexibility to the wireless video surveillance system. For example, the range of devices connected to the interface module may include a number of video cameras, one or more external movement detectors and multiple control lines (such as

30 light switches). Detection of movement would generate a warning signal that is transmitted to the portable monitor device. The user would then transmit a signal to select the video camera closest to the

detected movement. The video is then visible in the LCD 7 of the monitor 6.

The important elements of the portable monitor device 6 are shown in greater detail in FIG 5. The monitor includes a

- 5 receive/transmit module 23 for receiving the data transmitted by the interface module 2 and transmitting data to the interface module. Buffers 24 are provided for both transmission and reception. Received signals are processed in the CPU 25. On-board RAM 26 stores data and parameters for the signal processing. The processed image is
- 10 displayed on the liquid crystal display 7. Control signals input on line 27 are processed by the CPU 25 and transmitted to the interface module 2.

The portable monitor device can be any device capable of wireless network connection that has a graphic display and a general purpose processor. PDAs are preferred due to their availability but many mobile phones, such as WAP phones and I-NET phones are also suitable. Naturally, purpose built devices will also be suitable. The inventor envisages that hybrid devices that interface a custom DSP with a standard PDA will be useful. In this form, the video decoding process may be performed in the custom DSP instead of the CPU of the PDA.

Fig 6 shows an embodiment in which a VHS video camera 28 is connected to an interface module 29 that provides a low power signal 30 to an antenna 31 for a local area network. This embodiment may 25 have a typical range of 150m for signals 30. The signals 30 are typically radio frequency signals although infrared signals may also be suitable in point to point applications.

The monitor device 33 is a personal digital assistant with a wireless network card 34 and antenna 32 to receive signals 30. The 30 wireless network card 34 interfaces to the personal digital assistant through a PCMCIA slot, compact flash port, or other expansion port.

The embodiment of Fig 6 supports simplex video and full duplex

audio communication. It is most suitable for implementation in domestic applications, for child minding and security. For example, a parent may use the configuration to monitor a child sleeping in a separate room. Another application is to monitor an entryway. The full duplex audio

5 allows communication with a person seeking entrance while the simplex video channel allows the person to be viewed.

The primary advantage of the embodiment of Fig 6 is that the video monitor is portable and therefore the user can move freely around the home. It will be appreciated that this is a significant

10 improvement over known prior art security and child-minding systems.

For longer range applications the embodiment of Fig 7 is preferable. A digital video camera 35 provides audio and video input to the interface module 36. The transmission module 37 is a standard telephone interface for transmitting signals 38 across a CDMA or GSM

15 cellular phone network from antenna 39. The monitor device comprises a personal digital assistant 40 with a modem 41 connected to a phone 42. The PDA is programmed with algorithms to process the received data for display.

In a variation of this embodiment the PDA and phone are

20 integrated into a single device. Suitable devices have recently become commercially available.

As mentioned above, the embodiments provide simplex video and duplex audio communication. The second embodiment provides duplex audio via the phone. Duplex audio communication for the first

25 embodiment may be provided by built-in microphones provided in some PDA's or by an external microphone coupled to the network card.

These embodiments may be extended by providing local storage of audio and video footage which can be viewed on command from the monitor. Movement and sound detection functionality have also been

30 provided in the interface module so that an alarm can be provided if movement or sound is detected in the viewed scene. Combined movement detection, sound detection and local video storage are

particularly useful for the second embodiment to facilitate dial-up operation.

In one method of operation, the interface module is configured to detect movement in the field of view. When movement is detected the

5 video footage is stored locally and a call is placed to the portable monitor device. The phone touch tones or the duplex audio channel may then be used to send tone commands to trigger replay of the stored video footage. The great advantage of this systems is that security is provided without the need of a fixed base station with

10 permanent monitoring.

The external storage may be used to store a fixed period of data in one or more FIFO buffers. The size of the FIFO buffers (and hence the length of recorded video) can be a user set variable. When movement is detected the user can choose to view a block of video

15 from a fixed period before the alarm.

It will be appreciated that multiple cameras and interface modules can be programmed to a single or multiple video monitors. It would therefore be possible for a number of security guards to carry personal digital assistants providing mobile monitoring of multiple

20 camera installations.

Although the above embodiments only offer simplex video communication, it will be appreciated that the invention is not limited to this implementation. The provision of simplex rather than duplex video is due to the processing power available in commercial PDA's.

25 Improved processing power will allow the PDA's to run software that permits compression and transmission of video images. A video recording means is added to the portable monitor device for duplex video transmission.

It will be appreciated that suitable network protocols must be

30 used to ensure that video data is reliably transmitted across the wireless link to the remote monitor. These may be connection oriented, such as TCP, or connectionless, such as UDP. The nature of the

protocol will change depending on the nature of the wireless network being used, the bandwidth, and the channel characteristics. The protocol must perform the following functions: error control; flow control; packetisation; connection establishment; and link management.

5 There are many existing protocols for these purposes that have been designed for use with data networks. However in the case of video, special attention may be required to handle errors since retransmission of corrupted data is inappropriate due to the real-time constraints imposed by the nature of video on the reception and

10 processing of transmitted data.

To handle this situation the following error control scheme is provided.

(1) Frames of video data are individually sent to the receiver, each with a check sum or cyclic redundancy check appended to enable the receiver to assess if the frame has been received in error;

15 (2a) If there was no error then the frame is processed normally;

 (2b) If the frame is in error then the frame is discarded and a status message is sent to the transmitter indicating the number of the video frame that was in error;

20 (3) The video transmitter upon receiving such an error status message stops sending all predicted frames and instead immediately sends the next available key frame to the receiver;

 (4) After sending the key frame the transmitter resumes sending normal interframe coded video frames until another error status message is

25 received.

A key frame is a video frame that has only been intraframe coded but not interframe coded. Interframe coding is where the prediction processes is performed and makes these frames dependent on all the preceding video frames after and including the last key frame. Key frames are only sent as the first frame and whenever an error occurs. The first frame needs to be a key frame because there is no previous frame to predict from to perform the interframe coding

process.

Although the primary application is envisaged as being point-to-point, a broadcast implementation is also possible. In this case, there may be multiple monitors for a single base station. This implementation

5 may be particularly useful in a facility security application where a number of guards are monitoring the security of a facility from a variety of locations.

Authentication security may also be incorporated into the system to minimise the risk of unauthorised use if the portable monitor device

10 is lost or stolen. Suitable security protocols will be known to persons skilled in this area.

Throughout the specification the aim has been to describe the invention without limiting the invention to any specific combination of features.

CLAIMS

1. A wireless video surveillance system comprising:
at least one portable monitor device and first wireless communication means;
- 5 one or more video recording means for recording video images of a scene; and
at least one interface module converting said video images to transmittable data,
a second wireless communication means associated with said interface
- 10 module for transmission of said transmittable data from said at least one interface module to said portable monitor device, said portable monitor device incorporating means for receiving said transmittable data, converting said transmittable data to said video images and displaying said video images.
- 15 2. The wireless video surveillance system of claim 1 wherein the portable monitor device is a personal digital assistant or similar hand-held processing unit incorporating processor means, memory means and display means.
3. The wireless video surveillance system of claim 1 wherein the
- 20 interface module includes input means for receiving video signals from said video recording means.
4. The wireless video surveillance system of claim 1 wherein the video recording means is a digital camera
5. The wireless video surveillance system of claim 1 wherein the
- 25 video recording means is an analogue video camera.
6. The wireless video surveillance system of claim 5 wherein the interface module includes a video input means and analog to digital conversion means.
7. The wireless video surveillance system of claim 1 wherein the
- 30 interface module includes processing means for converting said video images to transmittable data and one or more transmission buffers.
8. The wireless video surveillance system of claim 7 wherein the

processing means is programmed with video and audio compression algorithms.

9. The wireless video surveillance system of claim 1 wherein the interface module includes processing means programmed with video and audio compression algorithms and wherein the portable monitor device incorporates a processor means programmed with corresponding audio and video decompression algorithms.
10. The wireless video surveillance system of claim 1 wherein the first wireless transmission means is a signal receiving means.
11. The wireless video surveillance system of claim 1 wherein the first wireless transmission means is a signal receiving and transmitting means.
12. The wireless video surveillance system of claim 1 wherein the second wireless transmission means is a signal transmitting means.
13. The wireless video surveillance system of claim 1 wherein the second wireless transmission means is a signal receiving and transmitting means.
14. The wireless video surveillance system of claim 1 wherein the second wireless communication means is integral with said interface module.
15. The wireless video surveillance system of claim 1 wherein the portable monitor device includes input means for inputting signals for transmitting to said interface module.
16. The wireless video surveillance system of claim 15 wherein said first wireless communication means includes means for transmitting said signals and said second wireless communication means includes means for receiving said signals.
17. A method of providing wireless video surveillance including the steps of:
 - 30 recording a video image of a scene;
 - processing the recorded image to form data for wireless transmission;
 - transmitting the data to a portable monitor device; and

processing the data to display the image on the portable monitor device.

18. The method of claim 17 wherein the step of processing the recorded image includes the further steps of compressing the image at 5 the interface means and decompressing the image at the portable monitor device.
19. The method of claim 17 further including the step of storing said data for later transmission.
20. The method of claim 17 further including the transmission 10 protocol steps of:
transmitting the data as individual frames of video data, said individual frames including key frames and predicted frames, each frame including a check sum or cyclic redundancy check appended to enable a receiver at the portable monitor device to assess if the frame has
- 15 been received in error;
if the frame is in error, discarding the frame and transmitting a status message indicating an identifier of the frame that is in error;
stopping the transmitting of predicted frames and transmitting the next available keyframe; and
- 20 after transmitting the keyframe resuming transmitting predicted frames.

ABSTRACT

A wireless video surveillance system incorporating a video recording means recording video images, an interface means converting the video images to transmittable data, and a portable monitor device for receiving the transmittable data, converting the data to video images and displaying the video images. The video recording means is suitably a commercially available video camera and the portable monitor device is suitably a commercially available personal digital assistant.

10 In one form, the PDA is able to transmit control signals to the interface means to control the video recording means. Other devices, such as an external data storage, movement detectors, sound detectors and light switches, may also be interfaced with the interface module.

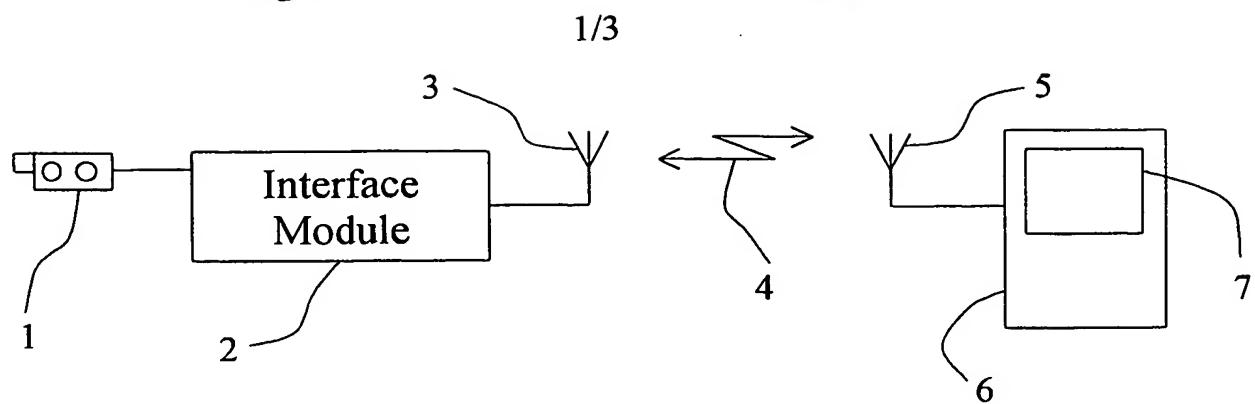


Fig 1

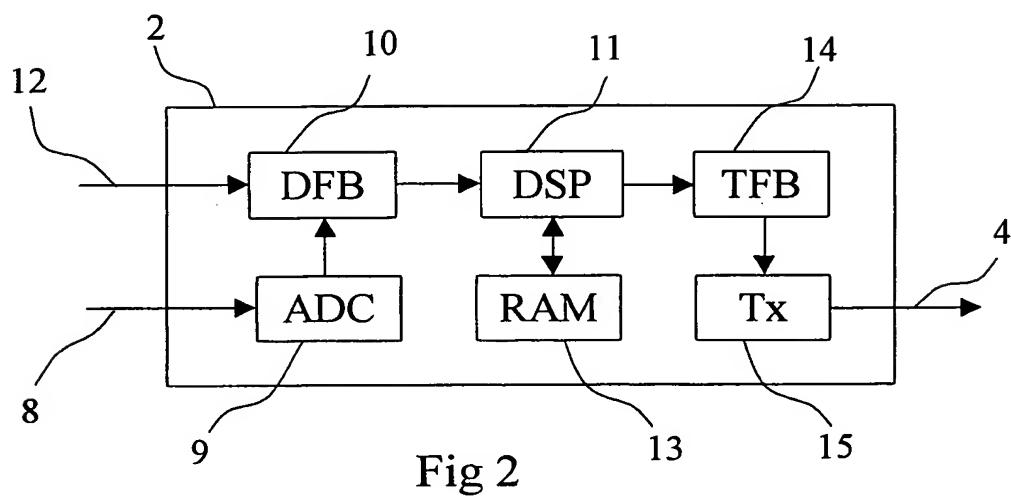


Fig 2

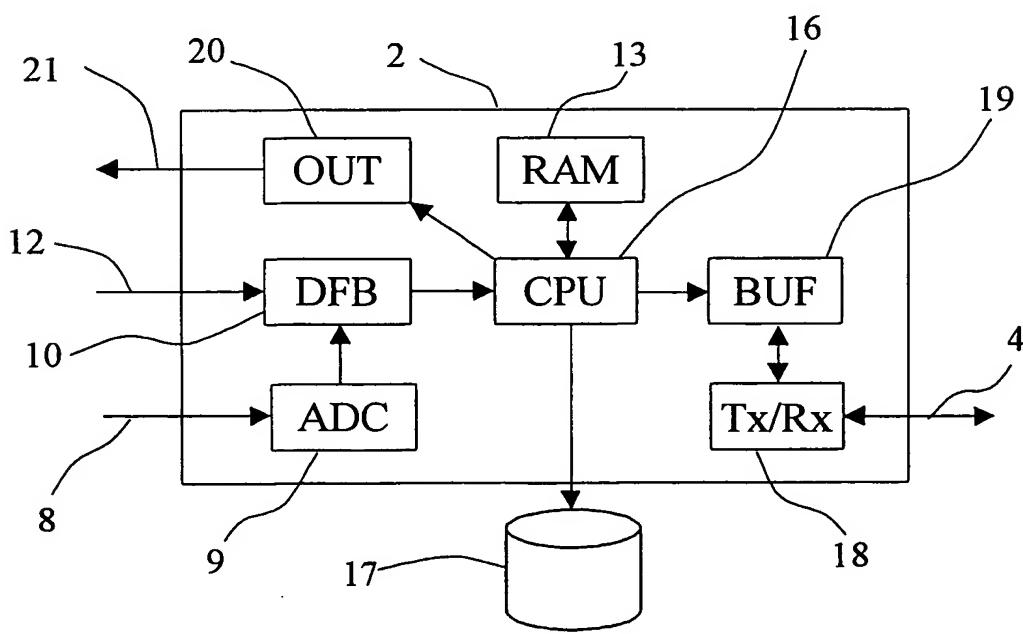


Fig 3

2/3

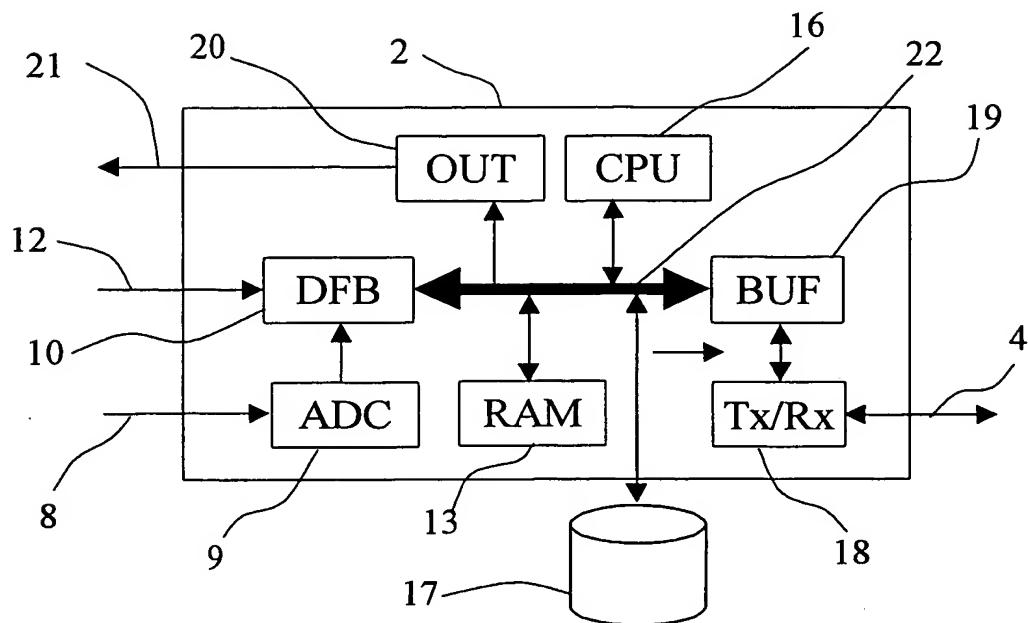


Fig 4

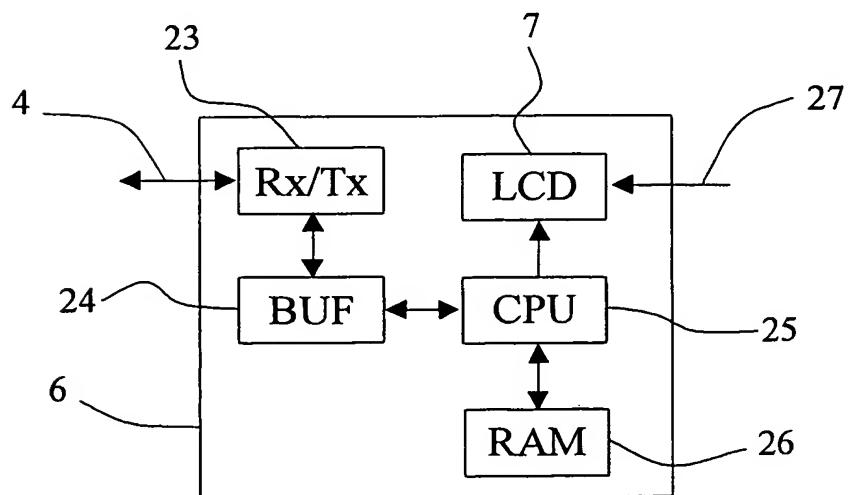


Fig 5

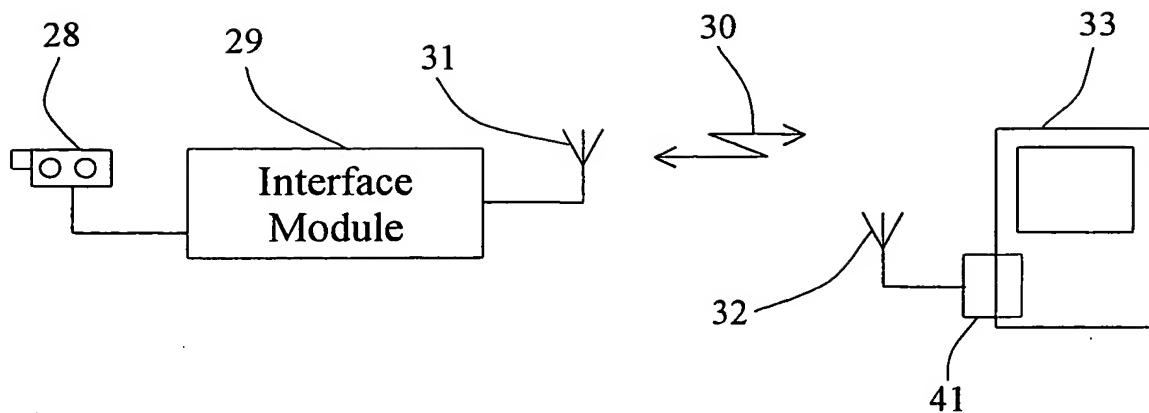


Fig 6

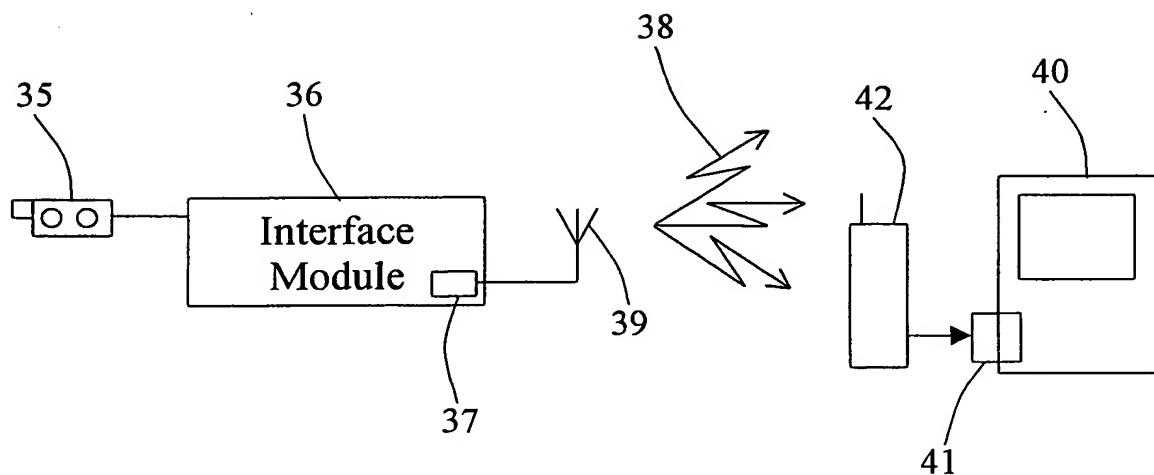


Fig 7

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

REC'D 21 JUL 2000

WIPO

PCT

Applicant's or agent's file reference 2/7970/PC	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/AU00/00364	International filing date (day/month/year) 26 April 2000	(Earliest) Priority Date (day/month/year) 22 April 1999
Applicant GONZALEZ, Ruben		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

contained in the international application in written form.

filed together with the international application in computer readable form.

furnished subsequently to this Authority in written form.

furnished subsequently to this Authority in computer readable form.

the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. Certain claims were found unsearchable (See Box I).3. Unity of invention is lacking (See Box II).4. With regard to the title, the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the abstract, the text is approved as submitted by the applicant

the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 1

as suggested by the applicant.

None of the figures

because the applicant failed to suggest a figure

because this figure better characterizes the invention

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00364

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ? H04N 7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: H04L; H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT, INSPEC: (video or imag+)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	US 6037991 A (Thro et al.) 14 March 2000 See column 4, line 66 to column 6, line 41 in particular	1 - 20
X	US 6028631 A (Nakaya et al.) 22 February 2000 (& WO 9627987, 12 September 1996) See the whole document, especially column 2, line 50 to column 3, line 44	1 - 20
X	US 5867821 A (Ballantyne et al.) 2 February 1999 See the whole document, especially column 5, lines 51 to 67	1 - 20

Further documents are listed in the continuation of Box C See patent family annex

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 7 July 2000	Date of mailing of the international search report 13 JUL 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer R.W.J. FINZI Telephone No : (02) 6283 2213

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00364

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97/26744 A (Robb) 24 July 1997 See the whole document	1 - 20
A	US 5995150 A (Hsieh et al.) 30 November 1999 See the whole document	1 - 20
A	EP 930770 A2 (MITSUBISHI DENKI KABUSHIKI KAISHA) 21 July 1999 See the whole document	1 - 20
A	US 5867795 A (Novis et al.) 2 February 1999 See the whole document	1 - 20

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU00/00364

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	6028631	WO	9627987				
US	5867821	CA	2125300				
WO	9726744	AU	13636/97	CA	2243244	CN	1208529
		EP	875109	GB	9600804		
US	5995150	AU	26843/99	EP	978195	WO	9943147
EP	930770	JP	11205761				

END OF ANNEX

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT PCT

REC'D 21 AUG 2001

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2/7970/PC	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).	
International Application No. PCT/AU00/00364	International Filing Date (day/month/year) 26 April 2000	Priority Date (day/month/year) 22 April 1999	
International Patent Classification (IPC) or national classification and IPC Int. Cl. 7 H04N 7/24			
Applicant ACTIVESKY, INC. et al			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 16 sheet(s).

3. This report contains indications relating to the following items:

I	<input checked="" type="checkbox"/> Basis of the report
II	<input type="checkbox"/> Priority
III	<input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	<input type="checkbox"/> Lack of unity of invention
V	<input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	<input checked="" type="checkbox"/> Certain documents cited
VII	<input type="checkbox"/> Certain defects in the international application
VIII	<input checked="" type="checkbox"/> Certain observations on the international application

Date of submission of the demand 22 November 2000	Date of completion of the report 14 August 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer <i>S. J. Samuel</i> SERINEL SAMUEL Telephone No. (02) 6283 2382

I. Basis of the report

1. With regard to the elements of the international application:*

 the international application as originally filed. the description, pages 2,6,10,11,13, as originally filed,
pages 3,5,8,9,12 received on 20 February 2001 with the letter of 20 February 2001
pages 1,4,7, received on 11 May 2001 with the letter of 11 May 2001 the claims, pages , as originally filed,

pages , as amended (together with any statement) under Article 19,

pages 15 received on 20 February 2001 with the letter of 20 February 2001

pages 14, 16-16b received on 11 May 2001 with the letter of 11 May 2001

 the drawings, pages , as originally filed,

pages , filed with the demand,

pages 1-3, received on 20 February 2001 with the letter of 11 May 2001

 the sequence listing part of the description:

pages , as originally filed

pages , filed with the demand

pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

 the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in written form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished4. The amendments have resulted in the cancellation of: the description, pages the claims, Nos. the drawings, sheets/fig.5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-33	YES
	Claims Nil	NO
Inventive step (IS)	Claims 1-33	YES
	Claims Nil	NO
Industrial applicability (IA)	Claims 1-33	YES
	Claims Nil	NO

2. Citations and explanations (Rule 70.7)

This invention relates to an apparatus and method for wireless video surveillance and communication. The invention is concerned with improving upon existing surveillance system for remotely watching persons or objects using the transmission of still or moving images via radio waves. The invention is concerned with overcoming the limitation to fix point monitoring by replacing the normal base station with a hand held portable monitor device.

The claimed invention is not disclosed in any single document or in combination of documents. Therefore the subject matter of these claims is new and meets the requirements of Article 33(2) of PCT with regard to the requirement for novelty and Article 33(3) of PCT with regard to inventive step.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/AU00/00364

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
US 6037991	14 March 2000	26 November 1996	26 November 1996

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. Claim 26 does not define the invention described because it omits the features of first and second wireless communication means which, from page 2, lines 15-19; are clearly being stated as essential to the invention.

REPLACED BY
ART 34 AMDT

analog to digital conversion means.

The interface module preferably also includes processing means for converting said video images to transmittable data and one or more transmission buffers.

5 The wireless transmission means is suitably a signal transmitting means but is preferably a signal receiving and transmitting means.

The processing means of the interface module is suitably programmed with video and audio compression algorithms.

10 Corresponding audio and video decompression algorithms are suitably programmed in the processor means of the portable monitor device.

The portable monitor device suitably also includes input means for inputting signals for transmitting to said interface module. Preferably said first wireless communication means includes means for transmitting said signals and said second wireless communication means includes means for receiving said signals.

15 In a further form, the invention resides in a method of providing wireless video surveillance including the steps of:

recording a video image of a scene;
processing the recorded image to form data for wireless transmission;
20 transmitting the data to a portable monitor device; and
processing the data to display the image on the portable monitor device.

25 Processing the recorded image preferably includes the steps of compressing the image at the interface means and decompressing the image at the portable monitor device.

The method may further include the step of storing said data for later transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Preferred embodiments of the invention are described with reference to the following figures in which:

FIG 1 is a block diagram of a first embodiment of the invention;

Alternatively a digital camera could be employed as the video recording means 1. In this case, the digital output from the camera can be input directly to the dual frame buffer 10 through USB port 12.

Although a USB port is described in the preferred embodiment, it will 5 be appreciated that other interface protocols such as SCSI, IEEE 1394, etc, can be used.

The digital signals are processed for transmission in the digital signal processing chip 11. The required processing will depend on the transmission network being employed and known signal processing 10 and compression algorithms can be used. Suitable algorithms include H.261, H.263, MPEG1, MPEG2, MPEG4, etc. Random access memory 13 is provided for on-board storage of data for signal processing.

Although a software implementation of the signal processing has been described, a hardware implementation is also suitable. In one 15 embodiment, signal processing can be performed using an ASIC (Application specific integrated circuit)/FPGA (Field programming gate array) solution. Alternatively, an ASIC front end can be used with a programmable DSP backend. The invention is not limited to any one of these possible solutions.

20 If a DSP solution is used, the DSP is programmed with available compression software. The invention is not limited to any particular software solution, although the inventor has 8-bit and 24-bit coding methods are suitable. Different coding methods may be more suitable for certain colour video displays available in the wide variety of PDA's 25 currently on the market. New coding solutions are regularly becoming available and the inventor recognises that the invention may employ new algorithms in the future.

The selected video compression method will implement three basic stages. The first stage performs temporal decorrelation, also 30 termed interframe coding. This process consists of an optional block based motion compensation step followed by temporal prediction and replenishment. This determines which portions of the image frame have

(including magnetic disks drives, digital tape drives, CD ROMs, DVDs, WORM drives, etc) with read-write, random access. There may be multiple external storage devices.

The external storage devices permit a history of video and audio

5 signals to be stored for review at a later time. One application of this arrangement is the removal and storage of recordings, such as video and audio tapes, for use in legal proceedings that could result from security breaches detected by the invention. Other applications are discussed below.

10 Signals 4 are sent and received by a transmit/receive means 18. A number of buffers 19 are provided for both transmission and reception. An output means 20 provides analogue or digital signals at port 21 for controlling various other devices in response to signals received from the portable monitor device. For example, a signal from

15 the portable monitor device could be used to turn lights on or off, reset a motion detector or external alarm, or commence video recording. In one application, a signal from the portable monitor device could be used to commence playback of a prerecorded programme stored on the external storage device 17.

20 A third embodiment of the interface module 2 is shown in FIG 4. This embodiment differs from the second embodiment by implementing a multiple address data bus 22. This embodiment facilitates the use of multiple external storage devices and multiple output means. It is also possible to implement multiple input sources which may each have a

25 unique address selectable from the portable monitor device. This embodiment provides maximum flexibility to the wireless video surveillance system. For example, the range of devices connected to the interface module may include a number of video cameras, one or more external movement detectors and multiple control lines (such as

30 light switches). Detection of movement would generate a warning signal that is transmitted to the portable monitor device. The user would then transmit a signal to select the video camera closest to the

detected movement. The video is then visible in the LCD 7 of the monitor 6.

The important elements of the portable monitor device 6 are shown in greater detail in FIG 5. The monitor includes a

5 receive/transmit module 23 for receiving the data transmitted by the interface module 2 and transmitting data to the interface module. Buffers 24 are provided for both transmission and reception. Received signals are processed in the CPU 25. On-board RAM 26 stores data and parameters for the signal processing. The processed image is

10 displayed on the liquid crystal display 7. Control signals input on line 27 are processed by the CPU 25 and transmitted to the interface module 2.

The portable monitor device can be any device capable of wireless network connection that has a graphic display and a general

15 purpose processor. PDAs are preferred due to their availability but many mobile phones, such as WAP phones and I-NET phones are also suitable. Naturally, purpose built devices will also be suitable. The inventor envisages that hybrid devices that interface a custom DSP with a standard PDA will be useful. In this form, the video decoding

20 process may be performed in the custom DSP instead of the CPU of the PDA.

Fig 6 shows an embodiment in which a VHS video camera 28 is connected to an interface module 29 that provides a low power signal 30 to an antenna 31 for a local area network. This embodiment may

25 have a typical range of 150m for signals 30. The signals 30 are typically radio frequency signals although infrared signals may also be suitable in point to point applications.

The monitor device 33 is a personal digital assistant with a wireless network card 34 and antenna 32 to receive signals 30. The

30 wireless network card 34 interfaces to the personal digital assistant through a PCMCIA slot, compact flash port, or other expansion port.

The embodiment of Fig 6 supports simplex video and full duplex

protocol will change depending on the nature of the wireless network being used, the bandwidth, and the channel characteristics. The protocol must perform the following functions: error control; flow control; packetisation; connection establishment; and link management.

5 There are many existing protocols for these purposes that have been designed for use with data networks. However in the case of video, special attention may be required to handle errors since retransmission of corrupted data is inappropriate due to the real-time constraints imposed by the nature of video on the reception and 10 processing of transmitted data.

 To handle this situation the following error control scheme is provided.

(1) Frames of video data are individually sent to the receiver, each with a check sum or cyclic redundancy check appended to enable the 15 receiver to assess if the frame has been received in error;

(2a) If there was no error then the frame is processed normally;

(2b) If the frame is in error then the frame is discarded and a status message is sent to the transmitter indicating the number of the video frame that was in error;

20 (3) The video transmitter upon receiving such an error status message stops sending all predicted frames and instead immediately sends the next available key frame to the receiver;

 (4) After sending the key frame the transmitter resumes sending normal interframe coded video frames until another error status message is 25 received.

 A key frame is a video frame that has only been intraframe coded but not interframe coded. Interframe coding is where the prediction processes is performed and makes these frames dependent on all the preceding video frames after and including the last key 30 frame. Key frames are only sent as the first frame and whenever an error occurs. The first frame needs to be a key frame because there is no previous frame to predict from to perform the interframe coding

WIRELESS VIDEO SURVEILLANCE SYSTEM

This invention relates to an apparatus and method for wireless video surveillance and communication. In particular, it relates to an apparatus and method employing commercially available, hand-held 5 portable devices, such as personal information managers and personal digital assistants.

BACKGROUND TO THE INVENTION

The use of personal digital assistants (PDA's), such as the 10 3COM Palm Pilot®, is becoming very widespread. Functionality of PDA's varies between manufacturers but all include a liquid crystal display, an input device, memory and a processor unit. Various improvements are constantly being made to increase available memory, improve processing power and extend software applications.

15 Recently, PDA manufacturers have released devices having colour liquid crystal displays and wireless communication capability. This innovation has been driven by a desire to provide PDA's with internet access for web surfing and e-mail. Similar market pressures are driving the integration of processing capability into mobile phones 20 to facilitate direct web access for the same purposes.

It is also known to integrate PDA's with mobile phones to provide 25 an integrated system giving full voice and data transfer facilities. One such system is described in United States patent number 5625673, assigned to Lucent Technologies Inc. The patent describes a PDA that includes means for cordless connection to specialised accessories, such as a cellular telephone and a modem.

The capabilities of PDA's have not been extended for application 30 in the video surveillance area. Existing surveillance systems, such as house security systems, do not normally offer a video surveillance capability. When such a capability is provided, it is usually linked to a base station that provides remote manual surveillance.

FIG 2 is a block diagram of a first embodiment of the interface module;

FIG 3 is a block diagram of a second embodiment of the interface module;

FIG 4 is a block diagram of a third embodiment of the interface module;

FIG 5 is a block diagram of the portable video monitor;

FIG 6 is a block diagram of a second embodiment of the invention; and

FIG 7 is a block diagram of a third embodiment of the invention.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG 1 there is shown a block diagram of a wireless video surveillance system consisting of a video recording means 1, in signal connection with an interface module 2 which is in signal connection with an antenna 3. Signals 4 are transmitted between the antenna 3 and an antenna 5 associated with a portable monitor device 6 which is a personal digital assistant or portable personal computer. Video images from the recorder 1 are displayed on a display 7 of the monitor 6.

Video and audio signals are transmitted from the interface module to the portable monitor device and control signals may be transmitted from the portable monitor device to the interface module.

In the video recording means 1 is a commercially available VHS video recorder having standard video and audio outputs. Other video formats may include PAL, NTSC, SVHS, BETACAM, RGB, SECAM and 25 DVD.

A first preferred embodiment of the interface module 2 is shown in greater detail in FIG 2. In this embodiment the interface module is configured to transmit signals to the portable monitor device but is not configured to receive signals. Video and audio input from the recorder 30 1 is input through port 8 and converted to digital form in analogue to digital converter 9. The output from the ADC is buffered in dual frame buffer 10 for input to a digital signal processor 11.

changed and selectively sends update information to reproduce the changes. This eliminates the need to retransmit the entire image each time when there have not been extensive change over time. A side product of this stage is that the output can be used to trigger an alarm 5 to be sent to the video monitor when any motion is detected.

Depending on the coding method used, quantisation may be performed at this point.

The next stage decomposes the resultant interframe images from the previous step into basic coding units. The nature of these 10 units varies depending on the coding method being used. In the classic transform based coding methods these coding units are 2D blocks of spatial frequency coefficients. These may equally be image primitives of another form such as run length vectors or uniform colour blocks. The values of the coding units are then substantially quantised 15 to eliminate unwanted information. This process is known as intraframe coding.

The final stage involves reordering the symbols or values to be coded so as to enhance compressability followed by some form of variable length or statistically based coding to efficiently create a 20 compact bit stream for each frame. This final stage is almost always lossless. This resulting bit stream is then appropriately packaged in a frame packet for insertion into the output data stream.

Audio coding will also be implemented in the DSP stage. In one embodiment a standard ADPCM compression method is used. GSM 25 speech coding will also be useful for use in conjunction with the integrated PDA/mobile phone scenario.

For each frame of video compressed and transmitted an audio frame of equivalent time duration will also be compressed and sent. In this way, excepting the event of system control frames in the data 30 stream, the predominant structure of the transmitted data stream will consist of alternating video and audio frames in an interleaved manner.

The processed data is buffered in transmission buffer 14 before

being transmitted by transmission module 15. The transmission module 15 can be any suitable wireless transmission system such as CDMA (code division multiple access), TDMA (time division multiple access), IP (wireless internet protocol), PHS (personal handyphone system), LMDS (local multipoint distribution service), wireless ATM, GSM, GPRS, HSCSD and other 3G wireless networks. Alternative embodiments are 5 discussed in detail below.

It will be appreciated that the elements of the interface module need not be physically contained in a single device. For example, the 10 transmission module may be separate from the rest of the interface module. For a wireless WAN protocol, the transmission module may be a GSM or CDMA base station connected to the rest of the interface module by a modem or ISDN connection. If the communication protocol is a wireless LAN, the transmission module may be connected to a 15 separate base station or wireless access point by an ethernet. The transmission module may also be a television frequency modulator to permit the device to transmit to a pocket television that may be in range.

A second embodiment of the interface module is shown in FIG 3. 20 This embodiment is configured to transmit signals to the portable monitor device as well as receive control signals. The DSP is replaced with a general purpose CPU 16. As with the first embodiment, video and audio signals are received at input 8, digitised by ADC 9, and buffered in DFB 10. Signals from a digital source can be input directly 25 on input 12.

As well as RAM 13 for local storage, an external storage device 17 is provided. The external storage device allows large volumes of data to be stored which can be accessed by signals from the portable monitor device. Two types of external storage devices may be 30 provided. Uncompressed analogue video data must be stored in a VCR which is accessed by a sequential, read-only access. Compressed digital data can be stored on any of a number of suitable devices

CLAIMS

1. A wireless video surveillance system comprising:
at least one portable monitor device and first wireless communication means;
- 5 one or more video recording means for recording video images of a scene; and
at least one interface module converting said video images to transmittable data,
a second wireless communication means associated with said interface
- 10 module for transmission of said transmittable data from said at least one interface module to said portable monitor device, said portable monitor device incorporating means for receiving said transmittable data, converting said transmittable data to said video images and displaying said video images.
- 15 2. The wireless video surveillance system of claim 1 wherein the portable monitor device is a personal digital assistant or similar hand-held processing unit incorporating processor means, memory means and display means.
3. The wireless video surveillance system of claim 1 wherein the
- 20 interface module includes input means for receiving video signals from said video recording means.
4. The wireless video surveillance system of claim 1 wherein the video recording means is a digital camera
5. The wireless video surveillance system of claim 1 wherein the
- 25 video recording means is an analogue video camera.
6. The wireless video surveillance system of claim 5 wherein the interface module includes a video input means and analog to digital conversion means.
7. The wireless video surveillance system of claim 1 wherein the
- 30 interface module includes processing means for converting said video images to transmittable data and one or more transmission buffers.
8. The wireless video surveillance system of claim 7 wherein the

processing means is programmed with video and audio compression algorithms.

9. The wireless video surveillance system of claim 1 wherein the interface module includes processing means programmed with video and audio compression algorithms and wherein the portable monitor device incorporates a processor means programmed with corresponding audio and video decompression algorithms.
10. The wireless video surveillance system of claim 1 wherein the first wireless transmission means is a signal receiving means.
- 10 11. The wireless video surveillance system of claim 1 wherein the first wireless transmission means is a signal receiving and transmitting means.
12. The wireless video surveillance system of claim 1 wherein the second wireless transmission means is a signal transmitting means.
- 15 13. The wireless video surveillance system of claim 1 wherein the second wireless transmission means is a signal receiving and transmitting means.
14. The wireless video surveillance system of claim 1 wherein the second wireless communication means is integral with said interface module.
- 20 15. The wireless video surveillance system of claim 1 wherein the portable monitor device includes input means for inputting signals for transmitting to said interface module.
16. The wireless video surveillance system of claim 15 wherein said first wireless communication means includes means for transmitting said signals and said second wireless communication means includes means for receiving said signals.
- 25 17. A method of providing wireless video surveillance including the steps of:
 - 30 recording a video image of a scene;
 - processing the recorded image to form data for wireless transmission;
 - transmitting the data to a portable monitor device; and

processing the data to display the image on the portable monitor device.

18. The method of claim 17 wherein the step of processing the recorded image includes the further steps of compressing the image at 5 the interface means and decompressing the image at the portable monitor device.
19. The method of claim 17 further including the step of storing said data for later transmission.
20. The method of claim 17 further including the transmission 10 protocol steps of:
transmitting the data as individual frames of video data, said individual frames including key frames and predicted frames, each frame including a check sum or cyclic redundancy check appended to enable a receiver at the portable monitor device to assess if the frame has 15 been received in error;
if the frame is in error, discarding the frame and transmitting a status message indicating an identifier of the frame that is in error;
stopping the transmitting of predicted frames and transmitting the next available keyframe; and
20 after transmitting the keyframe resuming transmitting predicted frames.

1/3

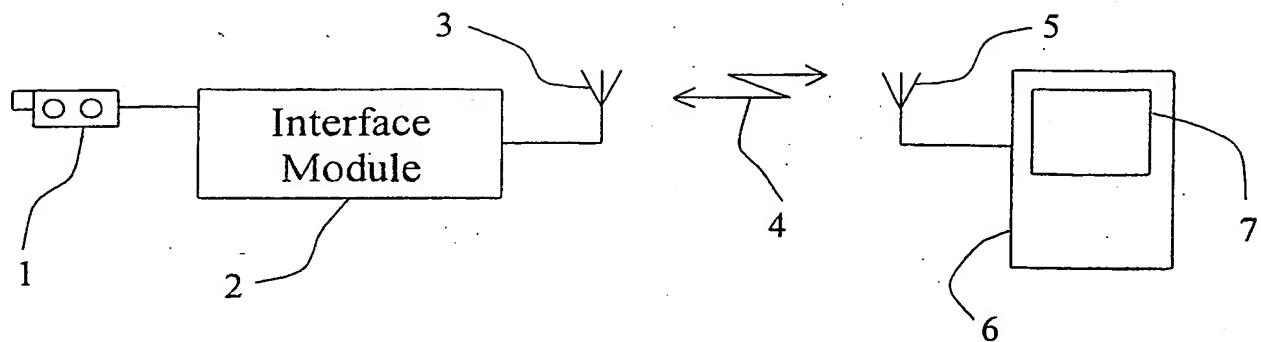


Fig 1

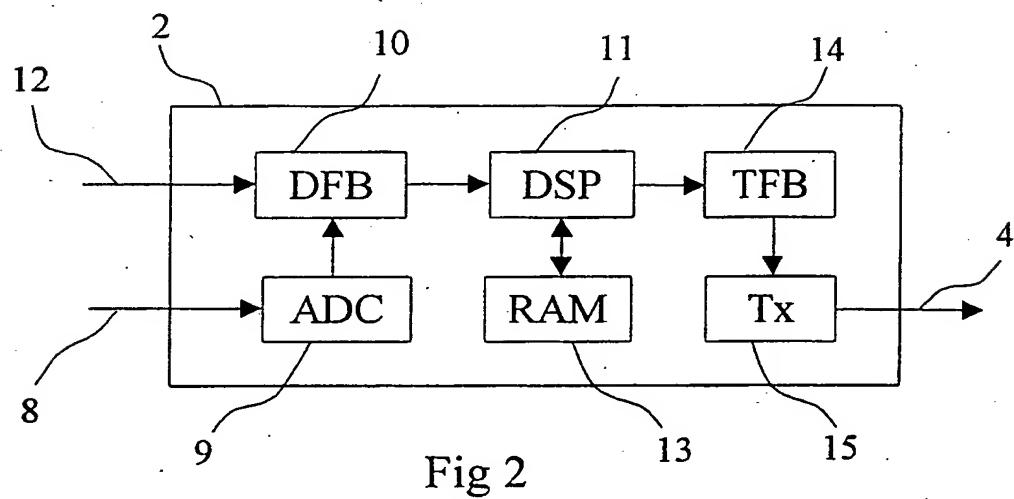


Fig 2

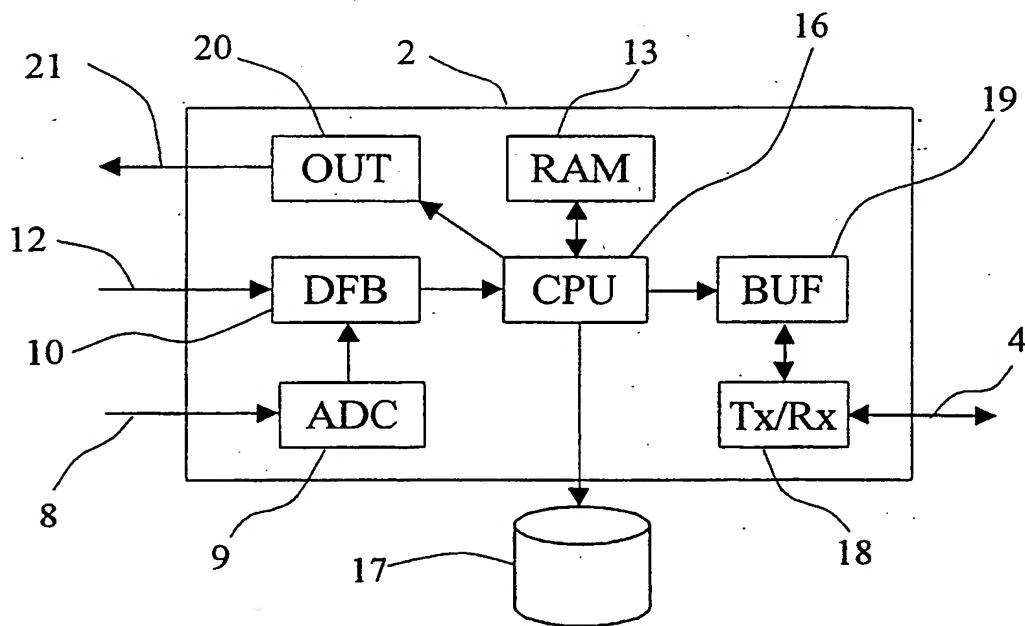


Fig 3

2/3

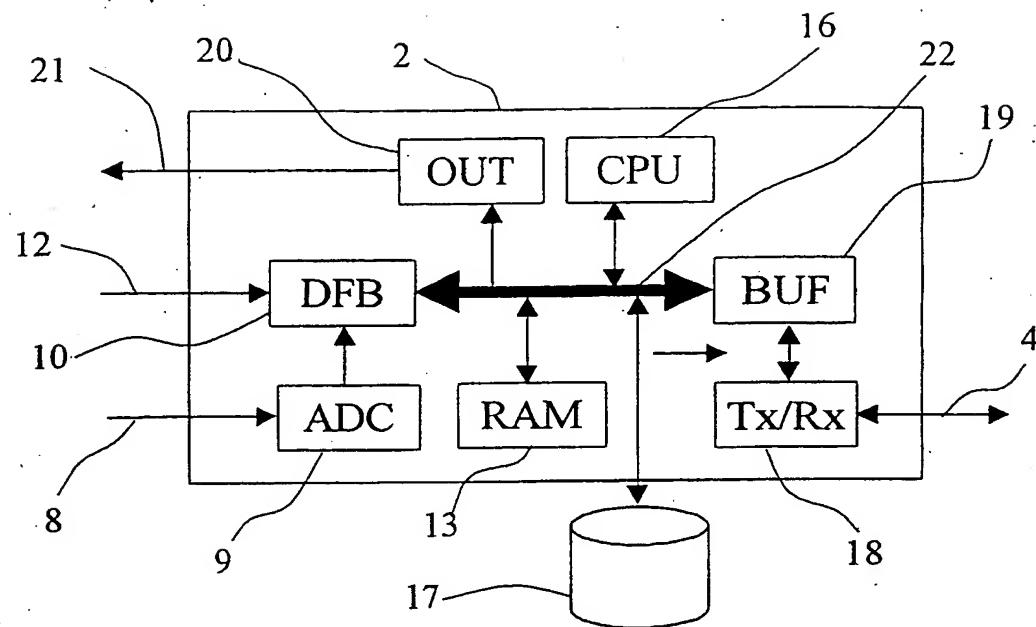


Fig 4

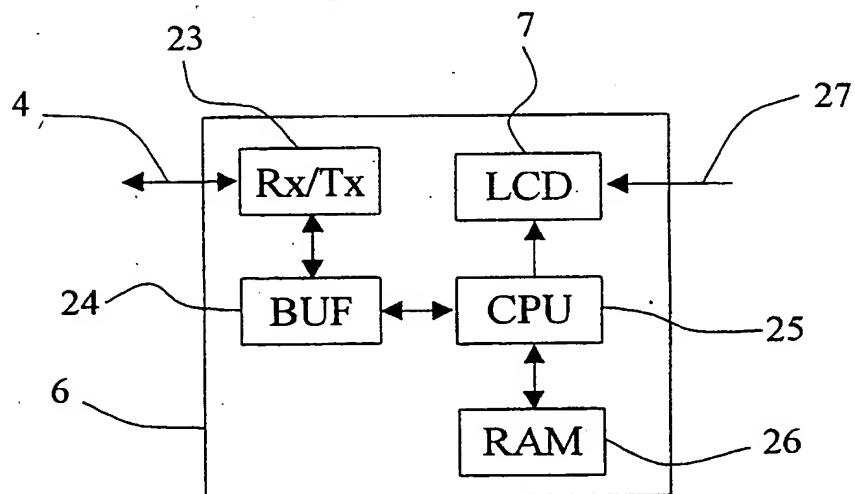


Fig 5

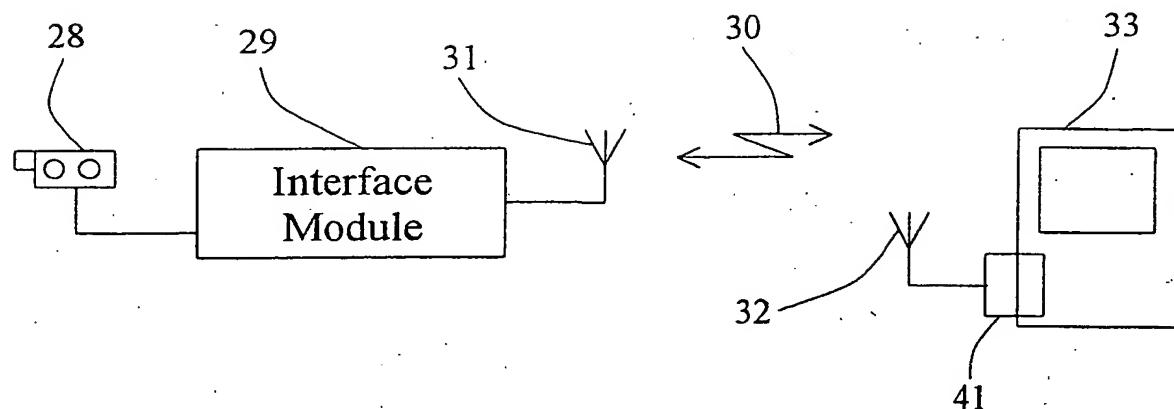


Fig 6

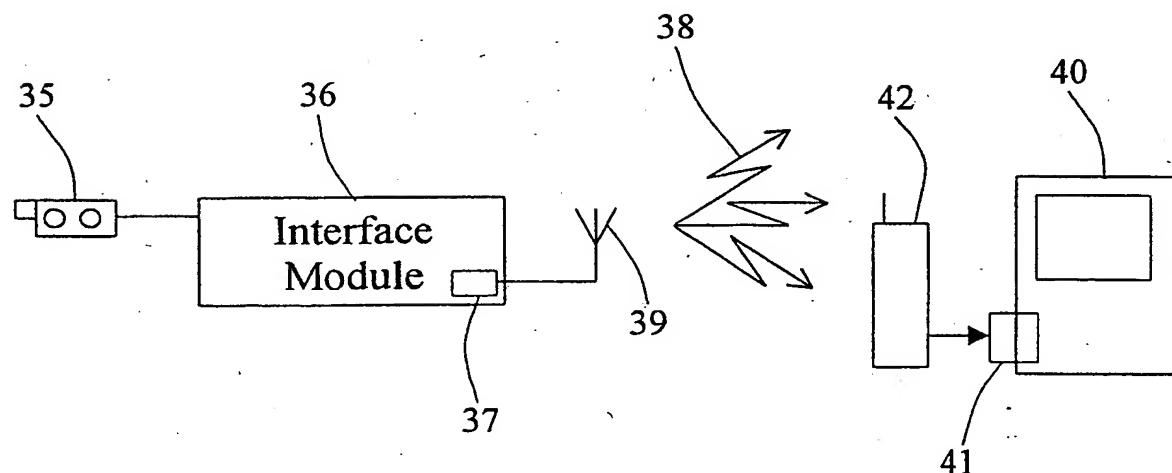


Fig 7

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2/7970/PC	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).	
International Application No. PCT/AU00/00364	International Filing Date (<i>day/month/year</i>) 26 April 2000	Priority Date (<i>day/month/year</i>) 22 April 1999	
International Patent Classification (IPC) or national classification and IPC Int. Cl. 7 H04N 7/24			
Applicant ACTIVESKY, INC. et al			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet. <input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
These annexes consist of a total of 16 sheet(s).
3. This report contains indications relating to the following items:
I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input checked="" type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input checked="" type="checkbox"/> Certain observations on the international application

Date of submission of the demand 22 November 2000	Date of completion of the report 14 August 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer  SERINEL SAMUEL Telephone No. (02) 6283 2382

I. Basis of the report

1. With regard to the elements of the international application:*

the international application as originally filed.

the description, pages 2,6,10,11,13, as originally filed,
pages 3,5,8,9,12 received on 20 February 2001 with the letter of 20 February 2001
pages 1,4,7, received on 11 May 2001 with the letter of 11 May 2001

the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages 15 received on 20 February 2001 with the letter of 20 February 2001
pages 14, 16-16b received on 11 May 2001 with the letter of 11 May 2001

the drawings, pages , as originally filed,
pages , filed with the demand,
pages 1-3, received on 20 February 2001 with the letter of 11 May 2001

the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
 the language of publication of the international application (under Rule 48.3(b)).
 the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

contained in the international application in written form.
 filed together with the international application in computer readable form.
 furnished subsequently to this Authority in written form.
 furnished subsequently to this Authority in computer readable form.
 The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. The amendments have resulted in the cancellation of:

the description, pages
 the claims, Nos.
 the drawings, sheets/fig.

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-33	YES
	Claims Nil	NO
Inventive step (IS)	Claims 1-33	YES
	Claims Nil	NO
Industrial applicability (IA)	Claims 1-33	YES
	Claims Nil	NO

2. Citations and explanations (Rule 70.7)

This invention relates to an apparatus and method for wireless video surveillance and communication. The invention is concerned with improving upon existing surveillance system for remotely watching persons or objects using the transmission of still or moving images via radio waves. The invention is concerned with overcoming the limitation to fix point monitoring by replacing the normal base station with a hand held portable monitor device.

The claimed invention is not disclosed in any single document or in combination of documents. Therefore the subject matter of these claims is new and meets the requirements of Article 33(2) of PCT with regard to the requirement for novelty and Article 33(3) of PCT with regard to inventive step.

VI. Certain documents cited**1. Certain published documents (Rule 70.10)**

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
US 6037991	14 March 2000	26 November 1996	26 November 1996

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. Claim 26 does not define the invention described because it omits the features of first and second wireless communication means which, from page 2, lines 15-19; are clearly being stated as essential to the invention.

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531 Rec'd CT/PT 21 OCT 2001

analog to digital conversion means.

The interface module preferably also includes processing means for converting said video images to transmittable data and one or more transmission buffers.

5 The second wireless communication means is suitably a signal transmitting means but is preferably a signal receiving and transmitting means.

The processing means of the interface module is suitably programmed with video and audio compression algorithms. Corresponding
10 audio and video decompression algorithms are suitably programmed in the processor means of the portable monitor device.

The portable monitor device suitably also includes input means for inputting signals for transmitting to said interface module. Preferably said first wireless communication means includes means for transmitting said
15 signals and said second wireless communication means includes means for receiving said signals.

In a further form, the invention resides in a method of providing wireless video surveillance including the steps of:
recording a video image of a scene;
20 processing the recorded image to form data for wireless transmission;
transmitting the data to a portable monitor device; and
processing the data to display the image on the portable monitor device.

Processing the recorded image preferably includes the steps of compressing the image at the interface means and decompressing the
25 image at the portable monitor device.

The method may further include the step of storing said data for later transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Preferred embodiments of the invention are described with reference to the following figures in which:

FIG 1 is a block diagram of a first embodiment of the invention;

Alternatively a digital camera could be employed as the video recording means 1. In this case, the digital output from the camera can be input directly to the dual frame buffer 10 through USB port 12. Although a USB port is described in the preferred embodiment, it will be appreciated 5 that other interface protocols such as SCSI, IEEE 1394, etc, can be used.

The digital signals are processed for transmission in the digital signal processing chip 11. The required processing will depend on the transmission network being employed and known signal processing and compression algorithms can be used. Suitable algorithms include H.261, 10 H.263, MPEG1, MPEG2, MPEG4, etc. Random access memory 13 is provided for on-board storage of data for signal processing.

Although a software implementation of the signal processing has been described, a hardware implementation is also suitable. In one embodiment, signal processing can be performed using an ASIC 15 (Application specific integrated circuit)/FPGA (Field programming gate array) solution. Alternatively, an ASIC front end can be used with a programmable DSP backend. The invention is not limited to any one of these possible solutions.

If a DSP solution is used, the DSP is programmed with available 20 compression software. The invention is not limited to any particular software solution, although the inventor has found that 8-bit and 24-bit coding methods are suitable. Different coding methods may be more suitable for certain colour video displays available in the wide variety of PDA's currently on the market. New coding solutions are regularly 25 becoming available and the inventor recognises that the invention may employ new algorithms in the future.

The selected video compression method will implement three basic stages. The first stage performs temporal decorrelation, also termed interframe coding. This process consists of an optional block based 30 motion compensation step followed by temporal prediction and replenishment. This determines which portions of the image frame have

devices.

The external storage devices permit a history of video and audio signals to be stored for review at a later time. One application of this arrangement is the removal and storage of recordings, such as video and 5 audio tapes, for use in legal proceedings that could result from security breaches detected by the invention. Other applications are discussed below.

Signals 4 are sent and received by a transmit/receive means 18. A number of buffers 19 are provided for both transmission and reception. An 10 output means 20 provides analogue or digital signals at port 21 for controlling various other devices in response to signals received from the portable monitor device. For example, a signal from the portable monitor device could be used to turn lights on or off, reset a motion detector or external alarm, or commence video recording. In one application, a signal 15 from the portable monitor device could be used to commence playback of a prerecorded programme stored on the external storage device 17.

A third embodiment of the interface module 2 is shown in FIG 4. This embodiment differs from the second embodiment by implementing a multiple address data bus 22. This embodiment facilitates the use of 20 multiple external storage devices and multiple output means. It is also possible to implement multiple input sources which may each have a unique address selectable from the portable monitor device. This embodiment provides maximum flexibility to the wireless video surveillance system. For example, the range of devices connected to the 25 interface module may include a number of video cameras, one or more external movement detectors and multiple control lines (such as light switches). Detection of movement would generate a warning signal that is transmitted to the portable monitor device. The user would then transmit a signal to select the video camera closest to the detected movement. The 30 video is then visible in the LCD 7 of the monitor 6.

The important elements of the portable monitor device 6 are shown in greater detail in FIG 5. The monitor includes a receive/transmit module

23 for receiving the data transmitted by the interface module 2 and transmitting data to the interface module. Buffers 24 are provided for both transmission and reception. Received signals are processed in the CPU 25. On-board RAM 26 stores data and parameters for the signal 5 processing. The processed image is displayed on the liquid crystal display 7. Control signals input on line 27 are processed by the CPU 25 and transmitted to the interface module 2.

The portable monitor device can be any device capable of wireless network connection that has a graphic display and a general purpose 10 processor. PDAs are preferred due to their availability but many mobile phones, such as WAP phones and I-NET phones are also suitable. Naturally, purpose built devices will also be suitable. The inventor envisages that hybrid devices that interface a custom DSP with a standard 15 PDA will be useful. In this form, the video decoding process may be performed in the custom DSP instead of the CPU of the PDA.

Fig 6 shows an embodiment in which a VHS video camera 28 is connected to an interface module 29 that provides a low power signal 30 to an antenna 31 for a local area network. This embodiment may have a typical range of 150m for signals 30. The signals 30 are typically radio 20 frequency signals although infrared signals may also be suitable in point to point applications.

The monitor device 33 is a personal digital assistant with a wireless network card 34 and antenna 32 to receive signals 30. The wireless network card 34 interfaces to the personal digital assistant through a 25 PCMCIA slot, compact flash port, or other expansion port.

The embodiment of Fig 6 supports simplex video and full duplex

protocol will change depending on the nature of the wireless network being used, the bandwidth, and the channel characteristics. The protocol must perform the following functions: error control; flow control; packetisation; connection establishment; and link management.

5 There are many existing protocols for these purposes that have been designed for use with data networks. However in the case of video, special attention may be required to handle errors since retransmission of corrupted data is inappropriate due to the real-time constraints imposed by the nature of video on the reception and processing of transmitted data.

10 To handle this situation the following error control scheme is provided.

 (1) Frames of video data are individually sent to the receiver, each with a check sum or cyclic redundancy check appended to enable the receiver to assess if the frame has been received in error;

15 (2a) If there was no error then the frame is processed normally;

 (2b) If the frame is in error then the frame is discarded and a status message is sent to the transmitter indicating the number of the video frame that was in error;

 (3) The video transmitter upon receiving such an error status message

20 stops sending all predicted frames and instead immediately sends the next available key frame to the receiver;

 (4) After sending the key frame the transmitter resumes sending normal interframe coded video frames until another error status message is received.

25 A key frame is a video frame that has only been intraframe coded but not interframe coded. Interframe coding is where the prediction processes is performed and makes these frames dependent on all the preceding video frames after and including the last key frame. Key frames are only sent as the first frame and whenever an error occurs. The first

30 frame needs to be a key frame because there is no previous frame to predict from to perform the interframe coding

8. The wireless video surveillance system of claim 7 wherein the processing means is programmed with video and audio compression algorithms.
9. The wireless video surveillance system of claim 1 wherein the 5 interface module includes processing means programmed with video and audio compression algorithms and wherein the portable monitor device incorporates a processor means programmed with corresponding audio and video decompression algorithms.
10. The wireless video surveillance system of claim 1 wherein the first 10 wireless transmission means is a signal receiving means.
11. The wireless video surveillance system of claim 1 wherein the first wireless transmission means is a signal receiving and transmitting means.
12. The wireless video surveillance system of claim 1 wherein the second wireless communication means is a signal transmitting means.
13. The wireless video surveillance system of claim 1 wherein the second wireless communication means is a signal receiving and transmitting means.
14. The wireless video surveillance system of claim 1 wherein the second wireless communication means is integral with said interface 20 module.
15. The wireless video surveillance system of claim 1 wherein the portable monitor device includes input means for inputting signals for transmitting to said interface module.
16. The wireless video surveillance system of claim 15 wherein said 25 first wireless communication means includes means for transmitting said signals and said second wireless communication means includes means for receiving said signals.
17. The wireless video surveillance system of any one of claims 1-16 further comprising motion detecting means for detecting motion occurring 30 within said scene.
18. The wireless video surveillance system of claim 17 wherein the motion detecting means activates a warning signal when a predetermined

WIRELESS VIDEO SURVEILLANCE SYSTEM

This invention relates to an apparatus and method for wireless video surveillance and communication. In particular, it relates to an apparatus and method employing commercially available, hand-held 5 portable devices, such as personal information managers and personal digital assistants.

BACKGROUND TO THE INVENTION

The use of personal digital assistants (PDA's), such as the 10 3COM Palm Pilot®, is becoming very widespread. Functionality of PDA's varies between manufacturers but all include a liquid crystal display, an input device, memory and a processor unit. Various improvements are constantly being made to increase available memory, improve processing power and extend software applications.

15 Recently, PDA manufacturers have released devices having colour liquid crystal displays and wireless communication capability. This innovation has been driven by a desire to provide PDA's with internet access for web surfing and e-mail. Similar market pressures are driving the integration of processing capability into mobile phones to 20 facilitate direct web access for the same purposes.

It is also known to integrate PDA's with mobile phones to provide an integrated system giving full voice and data transfer facilities. One such system is described in United States patent number 5625673, assigned to Lucent Technologies Inc. The patent describes a PDA that 25 includes means for cordless connection to specialised accessories, such as a cellular telephone and a modem.

The capabilities of PDA's have not been extended for application in the video surveillance area. Existing surveillance systems, such as house security systems, do not normally offer a video surveillance 30 capability. When such a capability is provided, it is usually linked to a base station that provides remote manual surveillance.

FIG 2 is a block diagram of a first embodiment of the interface module;

FIG 3 is a block diagram of a second embodiment of the interface module;

FIG 4 is a block diagram of a third embodiment of the interface module;

5 FIG 5 is a block diagram of the portable video monitor;

FIG 6 is a block diagram of a second embodiment of the invention; and

FIG 7 is a block diagram of a third embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

10 Referring to FIG 1 there is shown a block diagram of a wireless video surveillance system consisting of a video recording means 1, in signal connection with an interface module 2 which is in signal connection with an antenna 3. Signals 4 are transmitted between the antenna 3 and an antenna 5 associated with a portable monitor device 15 6 which is a personal digital assistant or portable personal computer. Video images from the recorder 1 are displayed on a display 7 of the monitor 6.

Video and audio signals are transmitted from the interface module to the portable monitor device and control signals may be transmitted from the portable monitor device to the interface module.

The video recording means 1 is a commercially available VHS video recorder having standard video and audio outputs. Other video formats may include PAL, NTSC, SVHS, BETACAM, RGB, SECAM and DVD.

25 A first preferred embodiment of the interface module 2 is shown in greater detail in FIG 2. In this embodiment the interface module is configured to transmit signals to the portable monitor device but is not configured to receive signals. Video and audio input from the recorder 1 is input through port 8 and converted to digital form in analogue to 30 digital converter 9. The output from the ADC is buffered in dual frame buffer 10 for input to a digital signal processor 11.

being transmitted by transmission module 15. The transmission module 15 can be any suitable wireless transmission system such as CDMA (code division multiple access), TDMA (time division multiple access), IP (wireless internet protocol), PHS (personal handyphone system), LMDS (local multipoint distribution service), wireless ATM, GSM, GPRS, HSCSD and other 3G wireless networks. Alternative embodiments are discussed in detail below.

It will be appreciated that the elements of the interface module need not be physically contained in a single device. For example, the 10 transmission module may be separate from the rest of the interface module. For a wireless WAN protocol, the transmission module may be a GSM or CDMA base station connected to the rest of the interface module by a modem or ISDN connection. If the communication protocol is a wireless LAN, the transmission module may be connected to a 15 separate base station or wireless access point by an ethernet.

A second embodiment of the interface module is shown in FIG 3. This embodiment is configured to transmit signals to the portable monitor device as well as receive control signals. The DSP is replaced with a general purpose CPU 16. As with the first embodiment, video and audio 20 signals are received at input 8, digitised by ADC 9, and buffered in DFB 10. Signals from a digital source can be input directly on input 12.

As well as RAM 13 for local storage, an external storage device 17 is provided. The external storage device allows large volumes of data to be stored which can be accessed by signals from the portable monitor 25 device. Two types of external storage devices may be provided. Uncompressed analogue video data must be stored in a VCR which is accessed by a sequential, read-only access. Compressed digital data can be stored on any of a number of suitable devices (including magnetic disks drives, digital tape drives, CD ROMs, DVDs, WORM drives, etc) with 30 read-write, random access. There may be multiple external storage

CLAIMS

1. A wireless video surveillance system comprising:
 - a) one or more video recording means for recording video images of a scene;
 - 5 b) at least one interface module for converting said video images to transmittable data; and
 - c) a hand-held portable monitor device comprising conversion and display means for respective conversion of said transmittable data to said video images, and display of said video images, said portable monitor device having first wireless communication means associated therewith for receiving said transmittable data from said interface module; wherein
 - 10 said interface module comprises second wireless communication means for transmission of said transmittable data from said interface module to said portable monitor device.
 - 15
2. The wireless video surveillance system of claim 1 wherein the portable monitor device is a personal digital assistant or similar hand-held processing unit incorporating processor means, memory means and display means.
- 20 3. The wireless video surveillance system of claim 1 wherein the interface module includes input means for receiving video signals from said video recording means.
4. The wireless video surveillance system of claim 1 wherein the video recording means is a digital camera
- 25 5. The wireless video surveillance system of claim 1 wherein the video recording means is an analogue video camera.
6. The wireless video surveillance system of claim 5 wherein the interface module includes a video input means and analog to digital conversion means.
- 30 7. The wireless video surveillance system of claim 1 wherein the interface module includes processing means for converting said video images to transmittable data and one or more transmission buffers.

threshold amount of movement is detected by the motion detecting means.

19. The wireless video surveillance system of claim 18 wherein said warning signal is transmitted to the portable monitor device.
- 5 20. The wireless video surveillance system of any one of claims 17-19 further comprising selection means for selection of a video camera which is closest to the detected motion.
21. The wireless video surveillance system as claimed in any one of claims 1-20 further comprising video footage storage means which can be viewed on command from the portable monitor device.
- 10 22. The wireless video surveillance system as claimed in any one of claims 1-21 further comprising audio footage storage means which can be viewed on command from the portable monitor device.
23. The wireless video surveillance system as claimed in any one of claims 17-22 wherein the interface module further comprises alarm activation means for activation of an alarm if motion is detected by the motion detecting means.
- 15 24. The video surveillance system as claimed in any one of claims 1-23 further comprising audio detecting means for detecting sound which originates from within said scene.
- 20 25. The video surveillance system as claimed in claim 24 wherein the interface module further comprises alarm activation means for activation of an alarm if sound is detected by said audio detecting means.
26. A method of providing wireless video surveillance including the 25 steps of:
 - recording a video image of a scene;
 - processing the recorded image to form data for wireless transmission;
 - transmitting the data to a hand-held portable monitor device;
 - processing the data to display the image on the portable monitor device,
- 30 30 wherein the step of processing the recorded image includes the further steps of compressing the image prior to transmission of the image to the portable monitor device and

decompressing the image at the portable monitor device.

27. The method of claim 26 wherein the step of compressing the image comprises the following sequential steps:

(1) Temporal decorrelation to determine which portions of an image frame

5 have changed to enable information to be selectively updated to reproduce the changes;

(2) Interframe coding comprising decomposition of interframe images resulting from step (1) into basic coding units and substantial quantisation of the basic coding units to eliminate unwanted information; and;

10 (3) Reordering of symbols or values to be coded to create a compact fit stream for each frame.

28. The method of claim 27 wherein step (1) comprises the following sequential steps:

(a) Optional block based motion compensation;

15 (b) Temporal prediction; and

(c) Replenishment.

29. The method of claim 27 wherein the reordering of symbols or values of step (3) comprises variable length based coding.

30. The method of claim 27 wherein the reordering of symbols or values 20 of step (3) comprises statistical based coding.

31. The method of claim 27 further comprising the step of activating an alarm if the temporal decorrelation of step (1) indicates that an image frame has changed.

32. The method of claim 26 further including the step of storing said 25 data for later transmission.

33. The method of claim 26 wherein the step of transmitting the data further indicates the steps of:

transmitting the data as individual frames of video data, said individual frames including key frames and predicted frames, each frame including

30 a check sum or cyclic redundancy check appended to enable a receiver at the portable monitor device to assess if the frame has been received in error;

- if the frame is in error, discarding the frame and transmitting a status message indicating an identifier of the frame that is in error;
- stopping the transmitting of predicted frames and transmitting the next available keyframe; and
- 5 after transmitting the keyframe resuming transmitting predicted frames.

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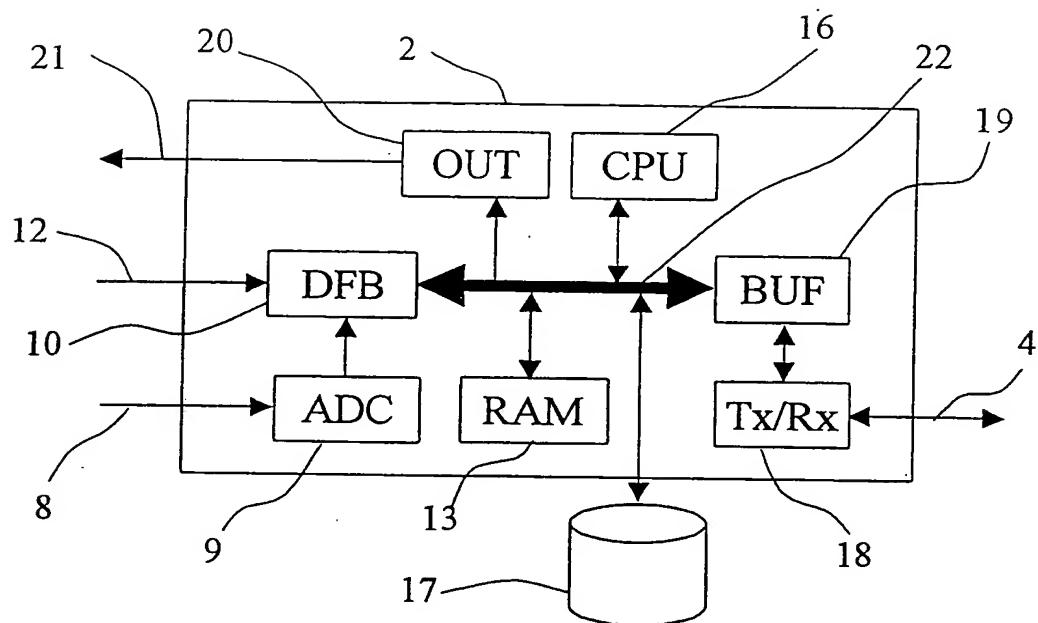


Fig 4

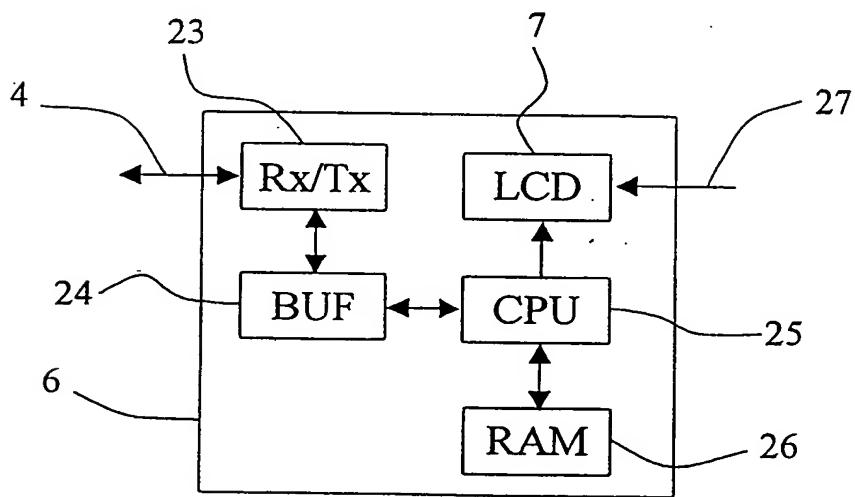


Fig 5

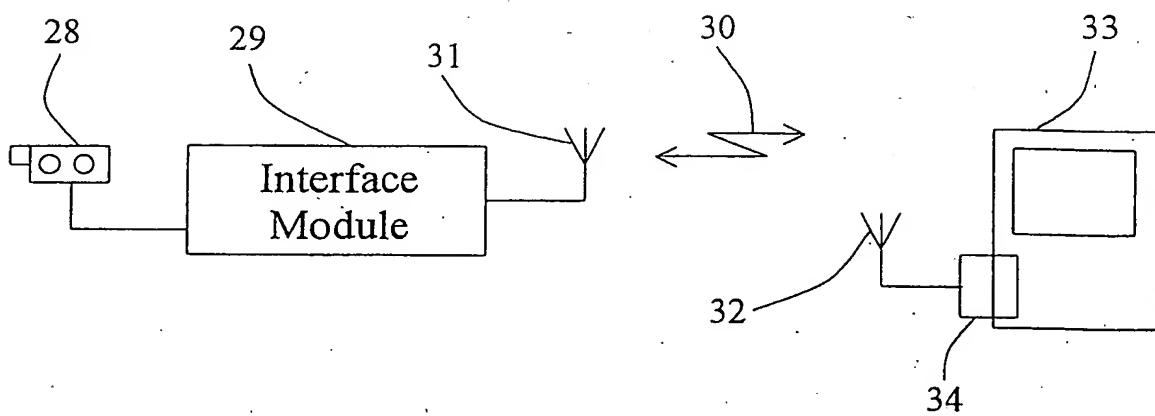


Fig 6

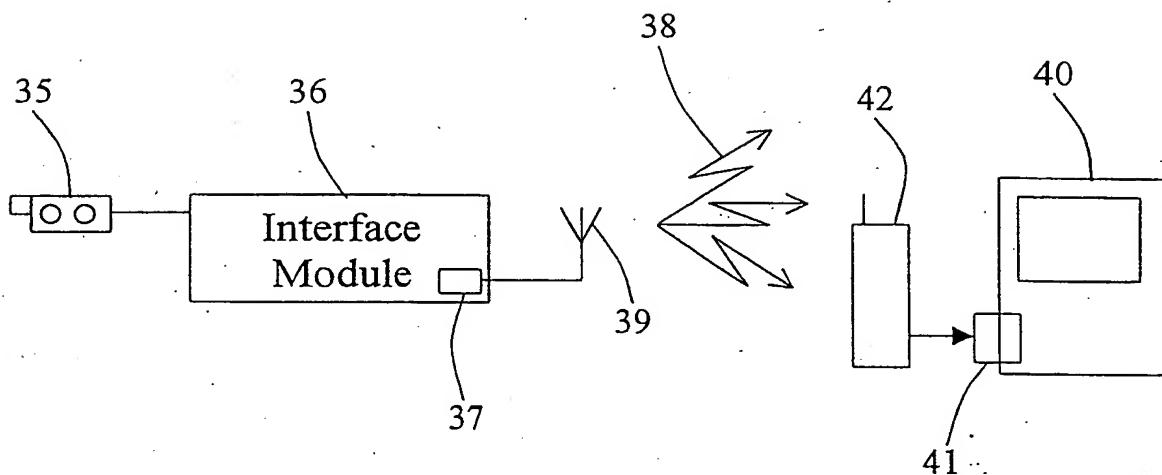


Fig 7

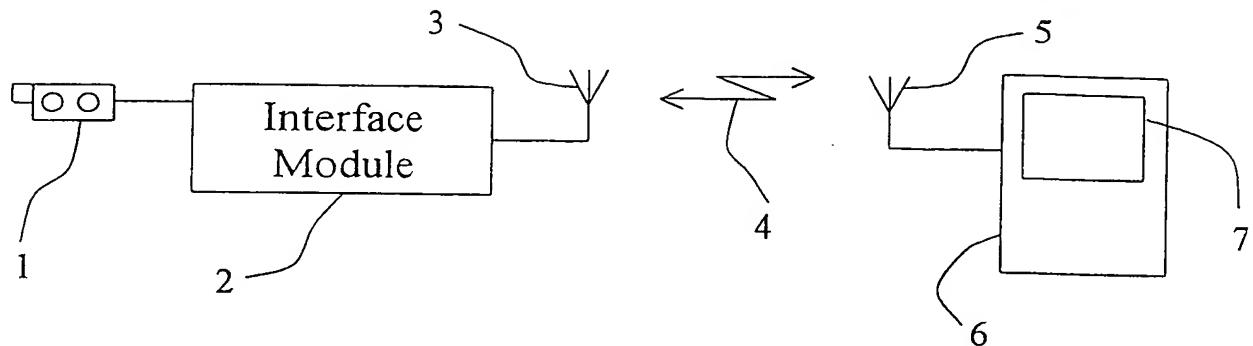


Fig 1

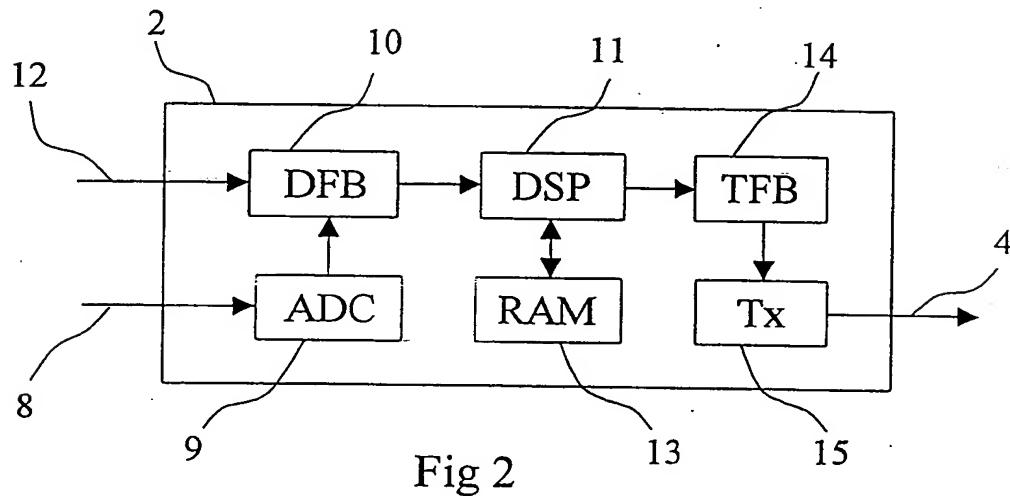


Fig 2

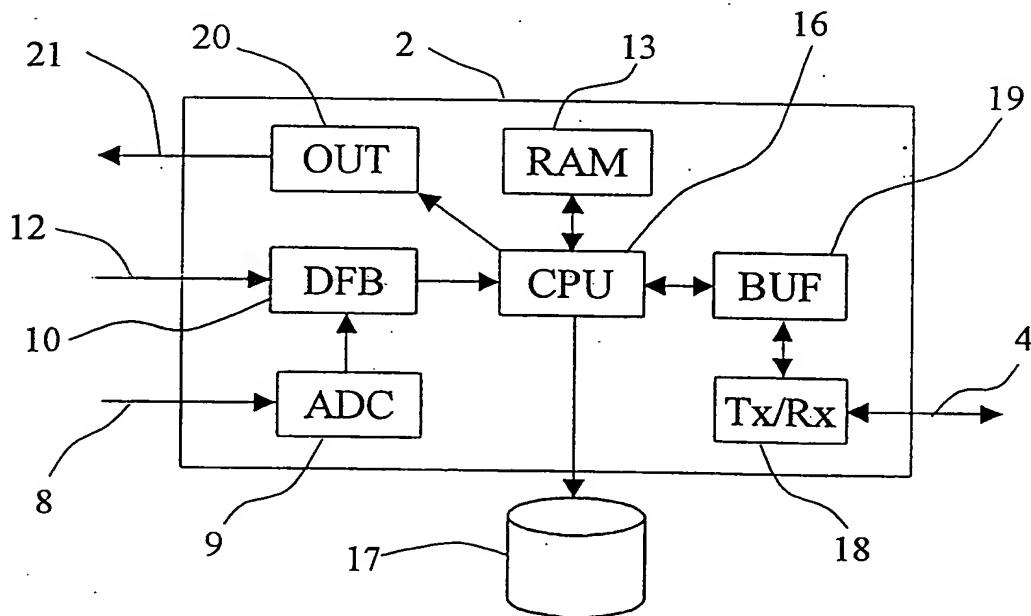


Fig 3

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